CLAIM SUMMARY DOCUMENT

Claims 1-28 (Canceled)

Claim 29 (New) An isolated DNA molecule comprising a nucleotide sequence encoding an N-methyl transferase of SEQ ID NO:1 and having the N-methyl transferase enzyme activities of 7-methylxanthine N3 methyl transferase, theobromine N1 methyl transferase and paraxanthine N3 methyl transferase.

Claim 30 (New) An isolated DNA molecule comprising a modified nucleotide sequence which hybridizes under stringent conditions to the complementary strand of the nucleotide sequence of Claim 29, where the polypeptide encoded by said modified nucleotide sequence maintains all of said N-methyl transferase enzyme activities and where hybridization of the modified nucleotide sequence to the complementary strand is carried out by the steps of

i. preparing a blocking reagent by preparing a solution consisting of 100 x Denhard't solution, 2 % (Weight/Volume) bovine serum albumin, 2 % (Weight/Volume) Ficll 400, 2 % (Weight/Volume) polyvinyl pyrrolidone at a 5-fold concentration and diluting the resultant solution to 1/20;

ii. preparing a hybridization buffer consisting of 0.1 wt. % sodium dodecyl sulfate, 5 wt. % Dextran sulfate, 1/20 volume of the blocking reagent and 2 to 7 x SSC provided that 20 x SSC is a 3M sodium chloride and 0.3M citric acid solution;

iii. treating a membrane to which the modified nucleotide sequence is transferred with a hybridization buffer including the complementary strand labeled by a label as a probe at a temperature between 40 to 80°C for at least several hours necessary for the hybridization;

iv. washing the membrane in a washing buffer; and

v. identifying the probe thus hybridized to the modified nucleotide sequence on the membrane.

Claim 31 (New) An isolated DNA molecule as claimed in claim 30, wherein said modified nucleotide sequence encodes the N-methyl transferase of SEQ ID NO:1.

Claim 32 (New) The isolated DNA molecule as claimed in claim 30, wherein the stringent hybridization conditions are at a temperature ranging from 40° to 80°C for a time period ranging from several hours to overnight.

Claim 33 (New) The isolated DNA molecule as claimed in claim 29 or 32, wherein said isolated DNA molecule consists of SEQ ID NO:2.

Claim 34 (New) An isolated RNA molecule comprising a nucleotide sequence encoding an N-methyl transferase of SEQ ID NO:1 and having the N-methyl transferase enzyme activities of 7-methylxanthine N3 methyl transferase, theobromine N1 methyl transferase and paraxanthine N3 methyl transferase.

Claim 35 (New) An isolated RNA molecule comprising a modified nucleotide sequence which hybridizes under stringent conditions to the complementary strand to the nucleotide sequence of Claim 34, where the polypeptide encoded by said modified nucleotide sequence maintains all of said N-methyl transferase enzyme activities and where hybridization of the modified nucleotide sequence to the complementary strand is carried out by the steps of

i. preparing a blocking reagent by preparing a solution consisting of 100 x Denhard't solution, 2 % (Weight/Volume) bovine serum albumin, 2 % (Weight/Volume) Ficll 400, 2 % (Weight/Volume) polyvinyl pyrrolidone at a 5-fold concentration and diluting the resultant solution to 1/20;

ii. preparing a hybridization buffer consisting of 0.1 wt. % sodium dodecyl sulfate, 5 wt. % Dextran sulfate, 1/20 volume of the blocking reagent and 2 to 7 x SSC provided that 20 x SSC is a 3M sodium chloride and 0.3M citric acid solution;

iii. treating a membrane to which the modified nucleotide sequence is transferred with a hybridization buffer including the complementary strand labeled by a label as a probe at a temperature between 40 to 80°C for at least several hours necessary for the hybridization;

iv. washing the membrane in a washing buffer; and

v. identifying the probe thus hybridized to the modified nucleotide sequence on the membrane.

Claim 36 (New) An isolated RNA molecule of claim 35, wherein said modified nucleotide sequence encodes the polypeptide of SEQ ID NO:1.

Claim 37 (New) The isolated RNA molecule as claimed in claim 35, wherein the stringent hybridization conditions are at a temperature ranging from 40° to 80°C for a time period ranging from several hours to overnight.

Claim 38 (New) The isolated RNA molecule as claimed in claim 34 or 37, wherein said isolated RNA molecule consists of SEQ ID NO:3.

Claim 39 (New) An expression vector comprising the DNA molecule as claimed in claim 29, and a plant promoter, wherein the vector expresses the N-methyl transferase in plant cells.

Claim 40 (New) An expression vector comprising the DNA molecule as claimed in claim 30, and a plant promoter for expressing an N-methyl transferase encoded by the DNA molecule in plant cells.

Claim 41 (New) A vector comprising a DNA molecule as claimed in claim 29.

Claim 42 (New) A vector comprising a DNA molecule as claimed in claim 30.

Claim 43 (New) The vector as claimed in claim 41, wherein the vector expresses an N-methyl transferase with 7-methyl xanthine N3 methyl transferase, theobromine N1 methyl transferase, and paraxanthine N3 methyl transferase activities in cells of at least one of microorganisms or plants.

Claim 44 (New) The vector as claimed in claim 42, wherein the vector expresses an N-methyl transferase with 7-methyl xanthine N3 methyl transferase, theobromine N1 methyl transferase, and paraxanthine N3 methyl transferase activities in cells of at least one of microorganisms or plants.

Claim 45 (New) A plant cell, plant tissue, or whole plant, wherein the plant cell, plant tissue, or whole plant is transformed with the vector as claimed in claim 41 or 43.

Claim 46 (New) A plant cell, plant tissue, or whole plant, wherein the plant cell, plant tissue, or whole plant is transformed with the vector as claimed in claim 42 or 44.

Claim 47 (New) The plant cell, plant tissue, or whole plant as claimed in claim 45, wherein the vector is introduced by infection.

Claim 48 (New) The plant cell, plant tissue, or whole plant as claimed in claim 46, wherein the vector is introduced by infection.

Claim 49 (New) A method for producing a plant secondary metabolite selected from the group consisting of 7-methyl xanthine, paraxanthine, theobromine and caffeine wherein the method comprises culturing the transformed plant cell, plant tissue or whole plant as claimed in claim 45 to form a plant body, and culturing said plant body to produce a plant secondary metabolite, wherein said plant cell, plant tissue or whole plant is a Camellia or a Coffea plant cell, plant tissue or whole plant.

Claim 50 (New) A method for modifying the concentration of caffeine wherein the method comprises: culturing the plant cell or plant tissue as claimed in claim 45 to form a plant body, and culturing said plant body to modify the concentration of caffeine, wherein said plant cell or plant tissue is a Camellia or a Coffea plant cell or plant tissue.

Claim 51 (New) The method as claimed in claim 49 wherein said transformed whole plant are cultured Camellia plant or cultured Coffea plant.

Claim 52 (New) A vector encoding the RNA molecule as claimed in claim 34.

Claim 53 (New) A vector encoding the RNA molecule as claimed in claim 35.